

INTRACRANIAL PRESSURE WITHOUT BRAIN TUMOR

DIAGNOSIS AND TREATMENT

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DURING the past seven years there have gradually accumulated 22 cases in each of which the signs and symptoms of intracranial pressure have been indubitable, and yet in none has there been an intracranial tumor or a space occupying lesion of any kind. Almost without exception a clinical diagnosis of an unlocalized brain tumor has been made; but by ventriculography a brain tumor has been excluded. All of these patients have complained of headache, most of them of nausea, vomiting, diplopia, dizziness, many of loss of vision, and objectively in every instance there have been bilateral papilledema and usually hemorrhages in one or both eyegrounds to indicate, or at least strongly suggest, that intracranial pressure of advanced degree was present. And in each case the intracranial pressure has been objectively demonstrated and usually actually measured by ventricular or lumbar punctures; and finally the subsequent demonstration of pressure over a period of months or years is merely a matter of inspecting the site of the subtemporal decompression to which most of these patients were subjected for treatment. The increased intracranial pressure may last only a few months, but it at times persists five to seven years, and doubtless longer. Curiously, the decompression is almost never consistently at its maximum fulness but is intermittent, and the pressure may come and go with surprising rapidity—from one extreme to the other in a few minutes. The cause of the sudden changes—indeed the cause of the increased pressure at all—is unknown.

HISTORIES OF THE CASES CONSIDERED

Case 1.—Unit 11820: B. O. F. Age 21. April 27 to May 14, 1927.

Complaints.—Headache and failing vision.

Present Illness.—Three months ago patient awoke from her sleep smelling illuminating gas. She tried to get up, but fell and struck the back of her head. She vomited that day and the following day. There has been headache in the occipital region since that time and she ascribes it to the injury of the head. The headache is worse in the morning. Since the original episode her vision has been failing; objects are indistinct and there are spots before her eyes. When she tries to read she becomes dizzy and the print melts away. Two weeks ago she thought she staggered, but this lasted only for a day.

Examination.—Patient is a normal appearing young woman of 21. There is papilledema of both eyegrounds, measuring two and one-half diopters on each side. There are several large hemorrhages alongside both disks (Fig. 1). Visual acuity is 20/15 in each eye. Visual fields are normal.

Trephine and Air Injection.—April 30, 1927. Fluid spurted under pressure. The ventriculograms, however, were entirely normal. Wassermann of the cerebrospinal fluid was negative.

Operation.—Right subtemporal decompression, May 6, 1927. The dura was quite

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tight and the brain bulged markedly through the bony defect. No note was made concerning the amount of fluid obtained at the operation.

Subsequent Course.—Patient was not seen again until November, 1936, at which time the decompression was soft and not bulging; however, it was not sunken. She says it has always varied, occasionally being prominent and fairly tense, and at other times sunken. This difference was particularly noticeable in the first two or three years following the operation, but recently the site of the decompression has not become full or tense.

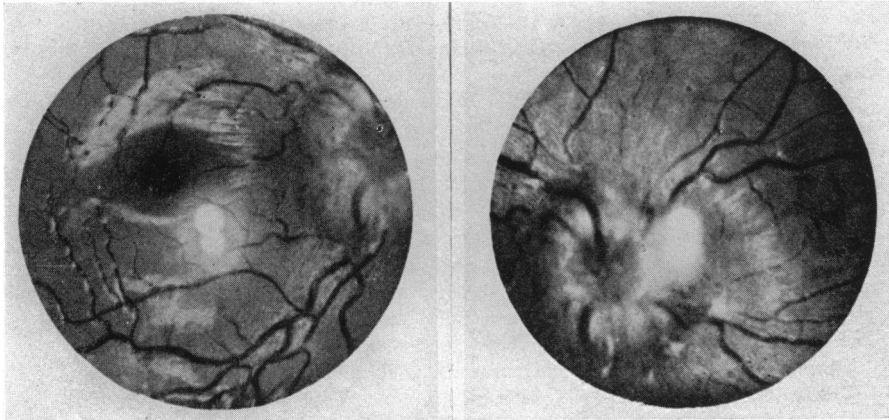


FIG. 1.—Eyegrounds in Case I showing numerous hemorrhages, fulness and tortuosity of veins and obliteration of the disks.

Case 2.—Unit 27949: V. R. F. Age 27. November 12 to November 22, 1929.

Complaints.—Headaches and failing vision.

Present Illness.—Patient was perfectly well in every way until two years ago when she awakened one morning with a severe occipital headache, nausea and vomiting varying from once a month to two or three times a week. For the past 18 months the associated nausea and vomiting have disappeared entirely. Seven months ago an ophthalmologist found bilateral choked disks. For the past six months there have been progressive visual disturbances; at times there are spells of momentary blindness which she thinks are more likely to develop when she has been exposed to a bright light. At times she has noticed a narrowing of the field of vision to such an extent that it appeared to her as though she were looking through a key hole. This has been more progressive in the right eye. Between attacks of disturbed vision the eyesight is clear. Her eyes ache at times and there may be flashes of light when she closes her eyes, particularly when she is facing a bright light. There has been a buzzing in the ears at times, also noise like escaping steam. Her friends have told her that she staggers when she walks. There have been three or four spells of numbness in the right side of the face, sharply down the midline; these last for an hour or more, after which the normal sensation returns.

Examination.—Bilateral papilledema of three diopters in the right eye and two diopters in the left. There are numerous large hemorrhages in and about the left disk. The visual acuity is 20/20 in the right eye and 20/30+ in the left. The blind spot is about four times its normal size in each field of vision. At one time a little hypo-esthesia was disclosed in the right trigeminal area; at other times this could not be found. There are no other positive neurologic findings. Her Romberg is negative, despite her history of staggering gait. The blood Wassermann was negative.

Trephine and Air Injection.—November 15, 1929. The left ventricle was tapped. Fluid spurted under great pressure and stopped abruptly when about 10 cc. had escaped. An equal amount of air was replaced. It was necessary to use pressure to force the air

into the ventricle. The ventricular system was small and perfectly normal in every way. The third ventricle was upright and in the midline.

Operation.—A right subtemporal decompression was performed, under avertin anesthesia, immediately after the ventriculograms had been interpreted. The dura was exceedingly tense, so much so that we were fearful of the cortical rupturing in opening it. The descending horn of the ventricle was tapped and some air and fluid escaped, reducing the pressure to a point where the dura could be opened safely. The brain bulged almost to the maximum degree. There was very little fluid on the surface of the brain. Because of the great tension of the brain it was not possible to close the temporal fascia.

Examination of the Cerebrospinal Fluid.—Eight cells, all lymphocytes; globulin negative; Wassermann negative.

Postoperative Course.—Uneventful. Decompression remained full and fairly tense during her stay in the hospital. She has not been seen since. The following report was contained in a letter received December 14, 1934, five years after the operation: "It was about a year and a half after the operation before I could walk without staggering, although this is the first time I have ever admitted it, and from that time on I got much better. The lump on my head remained about the same until last winter when it went down to almost normal and has since remained unchanged. I get very few headaches and usually know the reason. I cannot stoop over much, or keep going too long without paying with a headache. However, I am really just fine and feel great. My eyes do not bother me at all. Have gained in weight—present weight 150 lbs."

Case 3.—Unit 29509: M. C. M. Age 45. February 13 to March 1, 1930.

Complaints.—Dizzy spells and drowsiness.

Present Illness.—Ten months ago patient noticed a tendency to become drowsy. He would fall asleep when reading or sitting quietly; had a tendency to mix his words when he was talking, and he has had many spells in which both arms and legs would drop limp at his sides and he would be unable to talk. This would last from one to five minutes. Consciousness was not lost. There were no convulsions. He had no headaches. Diplopia has been present at times.

Examination.—Patient is a well developed, strong looking man. Blood pressure 120/80. The neurologic examination is negative except for a low grade papilledema in each disk; there are no hemorrhages.

Trephine and Air Injection.—February 18, 1930. Fifteen cubic centimeters of fluid were removed under great pressure. An equal amount of air was injected. The ventricular system was normal. The ventricular fluid showed no cells; no Pandy; negative Wassermann. Patient had a bradycardia at the time of his admission. During the next 48 hours he was somewhat stuporous, with a pulse running around 38 and 40.

Operation.—February 18, 1930. The left hemisphere was explored because of the history of weakness on the right side and difficulty in speech. There was moderately increased pressure, but the surface of the brain everywhere looked normal. The bone flap was removed for a decompression. The decompression bulged markedly at the time of his discharge from the hospital.

Case 4.—Unit 42619: A. C. F. Age 42. April 5 to May 12, 1932.

Complaints.—Dizziness, headache and double vision.

Past History.—Patient has always been extremely constipated. Because her basal metabolism was inconsistently low, ranging between -10 and -30 , for the past nine years she has been taking 1 to 3 gr. of thyroid extract daily.

Present Illness.—Eight months ago she began getting dizzy when changing from a sitting to a recumbent position, or vice versa; also when turning the head from side to side, and more especially when she leaned forward. This was during a very hot summer. At times when leaning forward there was momentary blurring of vision. A month later a terrific right side hemicrania lasted for an hour. During this time the vision was quite blurred and she was very dizzy; this attack began when she suddenly changed her position in bed. A month later, or five months ago, diplopia developed and the dizzy spells

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became so severe on changing position that she became frightened and was unwilling to lean forward to pick up anything. This condition remained essentially unchanged until a month ago when several more severe right sided headaches developed; the pain was more in the occipital region. There was a little nausea but no vomiting. Curiously, when the dizziness is on, it and the blurred vision can frequently be made to disappear instantly by throwing the head backward.

During the past two weeks there have been flushing spells, so severe that she feels that her face is burning up. She never had a keen sense of smell, but it has been worse in the past few years, and more so in the past few months.

Examination.—Patient is a brilliant, normal looking woman, without nervous tendencies. Blood pressure 112/76. Basal metabolism -17 . Both disks are swollen about four dipters. There are small hemorrhages about both disks. The visual fields and visual acuity are normal. Except for diminution of the sense of smell there are no other positive neurologic findings.

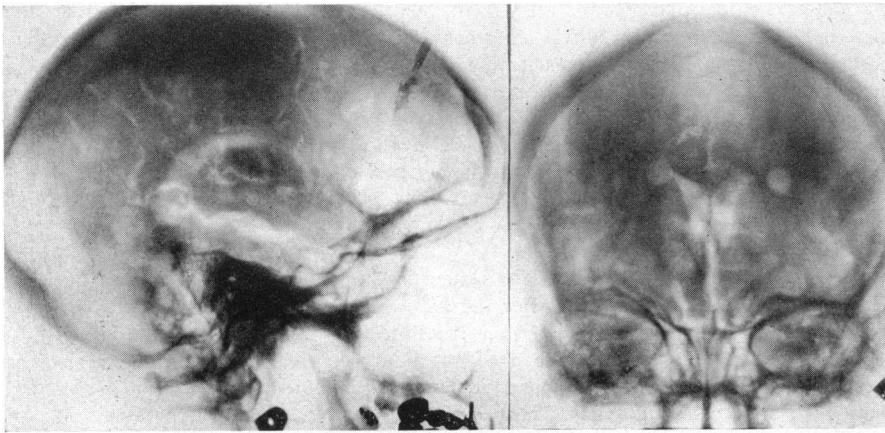


FIG. 2.—Lateral and anteroposterior views of ventriculograms of one of these patients showing small symmetrical ventricles, but no displacement. Given papilledema and intracranial pressure a tumor can be eliminated.

Cerebral Pneumography.—A ventricular air injection was attempted but neither lateral ventricle could be reached. A spinal air injection was then performed under gas anesthesia. Fluid spurted under pressure. In view of the type of anesthesia one could not be certain that the pressure was not due to the anesthetic. Seventy-five cubic centimeters of fluid were removed; this exhausted the cerebrospinal fluid. An equal amount of air was injected. The ventricular system was small but normal in every way (Fig. 2).

Five days later, without an anesthetic, a lumbar puncture was performed. The pressure was 300 Mm. of water. The fluid was clear, contained four cells; negative globulin and negative Wassermann.

Since the ventriculograms showed a normal ventricular system, a tumor could be excluded. The interpretation, therefore, was that there was intracranial pressure of undetermined cause.

Operation.—April 18, 1932. Under avertin anesthesia a second spinal air injection was done because we were still apprehensive that there might possibly be metastatic nodules which could so easily escape detection by an air injection, or perhaps even a tumor of the olfactory groove. Again the ventricular system was well filled and perfectly normal.

A right subtemporal decompression was then performed. Much to our surprise the brain was sunken beneath the dura. It was quite clear, therefore, that we were dealing

with a condition in which there were marked variations in the intracranial pressure. It is also worthy of note that there was no excess of fluid on the surface of the brain.

The postoperative course was uneventful. During her subsequent stay of three weeks in the hospital, the decompression remained, for the most part, full and tense, although there were times when it was quite flat and soft. Her diplopia and dizziness gradually diminished and had practically disappeared at this time. Up to the present time, five years later, neither the diplopia nor dizziness has ever reappeared. Her eyegrounds were found to be normal when examined a few months after her return home, and they have remained normal to date. The vision has been entirely normal. The decompression is still tense at times and it may be just as hard and tense as it was at the time of her operation five years ago. Perhaps more than half of the time it is soft and flat. She is well in every way and leads a very active life with many social activities (May 1, 1937).

I have been particularly eager to determine what may cause the rise and fall of the decompression, but on the whole have been quite unsuccessful. The pressure does appear to rise with any excitement, although this is not always true. A relationship with her obstinate constipation cannot be established, nor does the intake or restriction of fluid materially change it. She suffers no inconvenience whatever. There have been four or five convulsions during the past five years; none were present before. Since there is nothing connected with the air injections or decompression that could cause the convulsions, it has been assumed that they are in no way related to the intracranial condition that is responsible for the increased pressure. On the other hand, she is the only patient in the series who has had a convulsion subsequent to operation.

Case 5.—Unit 37125: B. P. F. Age 23. May 16 to 22, 1931, and again May 9 to 18, 1932.

Complaint.—Impairment of vision.

Present Illness.—Eight months ago patient became totally blind when changing from a recumbent to a sitting position. For the following six weeks the visual loss recurred several times a day. She is quite certain that shifting to other positions did not produce the same effect. Six months ago there were attacks suggesting right homonymous hemianopsia. Objects would disappear in the right half of her field. She had 100 or more such attacks during a day. Her eyes were then examined but nothing abnormal was found. Owing to the continuance of the same symptoms, a lumbar puncture was performed six weeks ago by Doctor Colella of Johnson City, N. Y. Fluid was said not to have been under pressure, although it was not measured. There was one cell and no globulin.

Five weeks ago headaches appeared in both frontal regions; these would last for two or three hours and disappear during sleep; they were throbbing and pounding in character. There had been nausea with the headaches, but no vomiting. In recent weeks the attacks of momentary blindness have come only in the right eye.

At the age of 14 or 15 (eight or nine years ago) she had some spells in which she could not get her breath. There is said to have been stertorous breathing. She could not talk, but understood what was said to her. These spells lasted about one-half hour and occurred once or twice a month. There were severe bifrontal headaches for about two hours after each attack.

Examination.—She is considerably over weight, weighing 150 pounds. At the age of 16 she weighed 192 pounds and two months ago, 170 pounds. The present reduction in weight has occurred without dieting. The neurologic examination reveals only one finding, namely, papilledema measuring three diopters in the right eye, and one diopter in the left. The veins are full and slightly tortuous. There are no hemorrhages in either eyeground. The visual acuity is 20/20 in the right eye and 20/15 in the left. The visual fields are normal. The blind spot in the right eye is enlarged to about three times its normal size; on the left it is normal.

Trephine and Air Injection.—May 19, 1931. Both ventricles were tapped. Fluid spurted under great pressure, then stopped abruptly. About 7 cc. of air were injected

into each ventricle. Pressure was required to inject the air. The ventriculograms were entirely normal.

Subsequent Course.—Since she could be carefully followed at home she returned, hoping the condition might clear spontaneously. Her blind spells decreased in number but still remained. Her headaches were improved for some time, but again reappeared. She was again having attacks similar to those she had had at the age of 14 or 15, and which she now recognized as being hysterical. Four months later a spinal puncture was performed; the pressure was 250 Mm.

She was again admitted to the hospital, May 9, 1932. Her papilledema now measured only one and one-half diopters in the right eye and one diopter in the left. The visual acuity was 20/20 in each eye; the disks were definitely paler than before. Lumbar puncture on two successive days registered 300 and then 400 Mm. of water.

On May 10, 1932, air was again injected into the lateral ventricles, which were, as previously determined, small and apparently normal. This time there were 16 mononuclear cells in the spinal fluid.

Operation.—May 10, 1932. A right subtemporal decompression was performed. The brain was very tense and bulged greatly but did not rupture when the dura was opened. There was no excess of fluid on the surface.

She returned for observation June 2, 1932, and stated that her headaches were less frequent and less severe. Two days after returning home her right arm and leg began to jerk occasionally and she could not control them so well. She says it caused her to break many dishes. She had another blind spell three days ago; on this occasion only the right eye was affected. The decompression was soft most of the time while at home, but has again become quite bulging and tense. Three days ago both legs became weak and she developed a stumbling gait. There still appears to be some slight motor weakness in the right hand and the finer movements are less well performed. There is no tremor; no ataxia and no astereognosis. She walks with a rather broad base, but there is no definite staggering, and her Romberg is negative.

She was again seen March 19, 1937. The decompression still protruded slightly, but it was quite soft. She says it does get more tense at times. Her vision is normal. Her blind spells have ceased. The disturbances with the legs, and particularly the right leg, and also the right arm, have cleared. She is quite nervous and has become addicted to drugs.

Case 6.—Unit 43567: C. B. F. Age 46. May 28 to June 11, 1932.

Complaints.—Headache and buzzing in the right ear.

Present Illness.—Began four months ago when she developed inconstant, dull, aching pain in the region of the right mastoid. There was also pain in the right frontal region, and a little tinnitus in the right ear. Dizziness has been present at times.

Examination.—Patient looks well, though somewhat overweight. Blood pressure 128/80. The neurologic examination is negative, except for papilledema of four diopters in each disk; there are numerous hemorrhages on both sides. Vision and visual fields are normal. Roentgenologic examination of the head is negative.

Trephine and Air Injection.—May 31, 1932. Fifteen cubic centimeters of fluid were removed from the right ventricle and an equal amount of air injected. The ventricular system was normal. The cerebrospinal fluid contained two cells and no globulin; Wassermann was negative. A spinal puncture was performed three days later; pressure was 550 Mm. of water.

Operation.—June 3, 1932. A right subtemporal decompression was performed. The brain was under great pressure and bulged almost to the maximum degree. The decompression was full and tense at the time of her discharge from the hospital.

Case 7.—Unit 45653: A. R. F. Age 34. October 3 to 25, 1932.

Complaint.—Headaches.

Present Illness.—Eight months ago patient had an attack of headache lasting three days; it was continuous day and night and was accompanied by nausea and vomiting.

The headache was more in the right frontal region than elsewhere, but it was also generalized. At the same time there was marked photophobia. A month later there was a similar attack lasting for five days. In the interim she had been well. Two months later a third attack lasted three weeks. She vomited three or four times a day. Two weeks later a fourth attack was accompanied by stiffness, and soreness in the neck and a sensation of pins and needles along the inner sides of both arms. The attacks since recurred about once a month. On her visit to the Johns Hopkins Dispensary during the past month, bilateral papilledema was discovered.

Examination.—A large, obese woman, age 34. Blood pressure 110/80; pulse 82; blood Wassermann negative. The neurologic examination reveals but one finding, namely, papilledema of about two diopters in each eye. The veins are full and tortuous but there are no hemorrhages. Visual acuity and visual fields are normal.

Trephine and Air Injection.—October 5, 1932. Twelve cubic centimeters of air were injected into the right ventricle. Fluid spurted under pressure. The ventriculograms showed a normal ventricular system. The fluid contained four mononuclear cells, no globulin. Four days later a lumbar puncture was performed. The pressure was 330 Mm. of water. The Queckenstedt test was normal. There was a response of over 20 Mm. on compression of each jugular, and 40 Mm. on compression of both.

Operation.—October 15, 1932. A right subtemporal decompression was performed. The dura was quite tense. A large amount of fluid escaped under pressure when the dura was opened; the fluid was in the subarachnoid space. After the fluid had escaped, the brain still bulged through the bony defect.

Subsequent Course.—The decompression was usually full and tense, but on many occasions was soft and sunken. When I saw her four months after the operation the decompression was soft, but protruding; she said that on the day preceding it had been so tight and hard that she could not lie upon it.

Her headaches continue, but with much less severity and are practically confined to the right side. These headaches come on an average of once a week and last for two or three days; they are sharp, like a knife thrust. There has been some dizziness during these attacks and some ringing in the right ear. She is quite sure that the headaches have no relationship to the tight decompression. She says they come just as much when the decompression is soft. Both disks are normal in outline and color, and the veins are of normal size.

Hoping to relieve the headaches, I removed the stellate ganglion. She went for three months without a headache, but they again recurred and were of the same type. She is quite nervous, cannot sleep at night and has bad dreams. How much her headaches are genuine and how much functional is difficult to determine.

At the time of my examination a year ago (May, 1936), the decompression was full and very tense.

Case 8.—Unit 46919: S. H. F. Age 32. December 15, 1932, to January 2, 1933.

Complaints.—Headaches; blurring of vision; colored spots before the eyes; double vision.

Past History.—Ovarian tumor was removed three years ago. Prior to this operation she had lost 40 pounds in weight; this has been regained. Her periods again became regular after the operation and have since been normal.

Present Illness.—Soon after her ovarian operation three years ago, occasional dull headaches began; they were more in the frontal and occipital regions, were not especially severe and occurred quite irregularly; at times they might come every two or three days, and again would not reappear for two or three months. Four months ago she began to tire easily, felt badly, and found it difficult to do her house work. Her condition was worse at the menstrual period, at which time there was a dull ache in the right side of her abdomen.

Five weeks ago a sudden, sharp pain developed in the back of the head, perhaps more severe on the left side; this pain has been continuous to date and is worse at night. There

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have been diplopia and black spots in front of her eyes. Three weeks ago her vision was found to be failing, particularly in the right eye, and a week later she was unable to see anything with this eye. There was vomiting on one occasion, three weeks ago. There was also a transient numbness in the left arm at that time. She staggered for a time and had ringing in the right ear. Four days ago, for no apparent reason, the vision returned in the right eye so that she had a definite field of vision, including colors.

Examination.—Patient is a large woman, considerably overweight (present weight 190 pounds). There is swelling of four diopters in each disk. There are numerous hemorrhages in both eyegrounds; the veins are full and tortuous. The visual acuity is 20/50+ in the right and 20/20 in the left eye; the field of vision is normal in the left and about one-fifth of the normal in the right. The neurologic examination otherwise is entirely negative. Vaginal examination reveals no signs of a tumor recurring from her operation of three years ago.

Tentative Diagnosis.—It was clear that patient had severe grade of intracranial pressure. The possibility of metastases from a malignant abdominal lesion was strongly considered.

Trephine and Air Injection.—December 20, 1932. Twenty cubic centimeters of fluid were removed from the right ventricle and 10 cc. of air injected. There were two cells in the fluid. I could not be sure about the degree of pressure. A lumbar puncture was performed four days later and the pressure registered 320 Mm. of water. The Queckenstedt test was normal; there was no globulin; Wassermann negative.

Operation.—December 24, 1932. A right subtemporal decompression was performed. A fair amount of fluid on the surface of the brain, which was very tense, but when the fluid had been evacuated the brain bulged but slightly.

Subsequent Course.—Letter received June 4, 1936 (three and one-half years after operation): Patient is well and does housework for family of six. Her vision is good in the left eye, still defective in the right. She has no headaches. The decompression swells at times, especially when tired, and goes down quickly when she rests.

Case 9.—Unit 60526: E. V. F. Age 9½. February 8 to 25, 1935.

Complaints.—Headaches and vomiting.

Present Illness.—Five months ago generalized headaches appeared, which occurred in spells and quite frequently. Two and one-half months ago she fell off her horse, struck her left jaw, was not unconscious, but was somewhat dizzy. She rode the horse home; vomited that night after dinner but seemed her usual self the next day. Her parents thought the headaches became more frequent following this injury. Two months ago one of the episodes of headache and vomiting lasted five days, but following this she was well for nearly a month, when the headaches again returned, accompanied by vomiting. At this time she had an attack that lasted eight days. Her urine was said to have contained acetone and her NPN. was elevated to 68 mg. Four days later the blood chemistry was within its normal limits. About this time diplopia was first noted and an examination of the fundi revealed bilateral papilledema. Ten days ago a lumbar puncture was performed at her home in Mexico City; xanthochromic fluid was said to have been recovered; Pandy was positive, four cells. Her physician also noted paralysis of the left external rectus muscle.

During this time the headaches continued. There was numbness of the hands at times, during the past month. The headaches have never been localized. Appetite has been rather poor during the past month. There has been no disturbance in gait; no convulsions and no change in personality.

Examination.—An undernourished girl is in bed because she feels ill. Blood pressure 120/70; pulse 90 to 100. Tuberculin test (0.1 mg.) was markedly positive.

The neurologic examination is negative, except for papilledema of three diopters in each eye. There are several hemorrhages in the right disk; the veins are full and tortuous. The appearance of the left disk is essentially similar, except that there are no

hemorrhages. The visual acuity is 20/50 in each eye. Visual fields are normal. There are no scotomata. The abducens palsy has disappeared.

Operation.—An air injection was performed February 8, 1935. The ventricular system was perhaps a trifle enlarged, although within the limits of normal. There did not appear to be any pressure, although this could not be definitely determined. The ventricular fluid contained no cells and no globulin. A guinea-pig which was injected with this fluid later died of tuberculosis.

One week later a spinal puncture was made without anesthesia. The pressure registered 500 Mm. of water. There were two cells in the spinal fluid; Pandy was negative. A guinea-pig was also injected with this fluid and eventually died of tuberculosis.

A right subtemporal decompression was performed February 15, 1935. The dura was very tense; when opened the fluid poured out in tremendous quantities, much as obtains in fractures of the skull. We looked carefully for evidence of tuberculosis, but none could be found. Even with the escape of the tremendous amount of fluid, and the loss of 85 cc. of fluid from the lumbar puncture immediately preceding the anesthetic, the brain was now only flush with the dura. After operation the decompression was never tense. She left the hospital February 25, 1935, quite free from symptoms.

Subsequent Course.—A letter received from the father March 12, 1937, two years after operation, stated that the patient had been entirely free from symptoms up to that date and was well in every way. Her physician reported normal eyegrounds and normal vision. We had been apprehensive because two guinea-pigs had died of tuberculosis.

Case 10.—Unit 66287: A.M. M. Age 44. November 22 to December 9, 1935.

Complaints.—Headaches and dizzy spells.

Present Illness.—Dull headaches have been present in the right frontal region for the past eight months; they come in spells lasting several hours and occur almost daily. They have not become more severe nor more frequent. On two occasions he has had a feeling of giddiness; once so severe that he fell.

Examination.—Patient is a large, well nourished man, seemingly in good health. The physical examination is negative. Blood pressure 118/64. The neurologic examination is negative except for papilledema of three diopters in each eye. There are numerous small hemorrhages on both sides. Vision is normal. Roentgenologic examination of the head is normal.

Trephine and Air Injection.—November 26, 1935. Fluid spurted under high pressure but only 55 cc. of fluid were obtainable. Ten cubic centimeters of air were injected. The ventricular system was normal. The cerebrospinal fluid was not examined.

Operation.—November 26, 1935. Immediately after the ventriculograms were read, a right subtemporal decompression was performed. The brain was under tremendous pressure. Despite the release of a considerable quantity of fluid, the brain still protruded markedly.

Subsequent Course.—The decompression was full and tense at the time of his discharge from the hospital.

I examined the patient again March 17, 1937, 16 months after the operation. He was quite well and plays golf. The decompression was full and tense. He says it is that way very much of the time but is also frequently flat. When the decompression is very tense there is a little headache and the eyes feel as though they were being pushed out; at these times there are colored rings about both eyes. The vision and visual fields are normal; the disks are sharply defined and the veins of normal appearance. He says reading, talking and nervousness quickly cause the decompression to become tense and full—the time required for it to change from one extreme to the other is less than two minutes. He also thinks the decompression becomes more tense when he is constipated.

Case 11.—Unit 66817: R.H. F. Age 41. December 20 to 30, 1935.

Complaint.—Blurring of vision in the left eye.

Present Illness.—One and one-half years ago an intermittent blowing sound developed in the right ear. This was synchronous with the heart beat. She found by lying in

certain positions or by holding the upper right side of her neck with her hand the noise would stop. The noise occurred irregularly, and was not sufficiently disturbing to keep her awake. Three months ago blurring of vision was noted in the left eye. This was not associated with any other symptoms. She is quite certain that she has had no headache, and aside from loss of vision there have been no other disturbances.

Examination.—Patient is a well nourished, normal looking woman, a little overweight. Blood Wassermann negative. Blood pressure 140/76. Roentgenologic examinations of the head are negative. In each fundus there is papilledema of three diopters; large hemorrhages cover both eyegrounds. Visual acuity is 20/20 in the right eye; 20/40 in the left. Visual fields are normal. The blind spots are slightly enlarged.

Trephine and Air Injection.—December 21, 1935. Fluid spurted under great pressure; only a few cubic centimeters of ventricular fluid escaped. Ten cubic centimeters of air were injected. The ventricular system was normal in every way, but both lateral ventricles were markedly undersized.

Operation.—A right subtemporal decompression was performed the same day. The dura was exceedingly tense and the brain bulged greatly when it was opened. However, there was quite a free flow of fluid from the subarachnoid space and before the operation was concluded the brain was flush with the level of the dura, but not beneath it. There were no signs of abnormalities in the brain. The patient was discharged December 30, 1935; the decompression was full and tense.

Subsequent Course.—A letter from her husband February 4, 1937 (15 months after operation), states: "Mrs. H. feels fine. She doesn't sleep very well at night. The bump on her head where she was operated seems swollen quite a bit, but otherwise she is in fine health." Visual acuity and visual fields taken by Dr. Walter R. Parker, of Detroit, were normal.

Case 12.—Unit 67385; S.W. F. Age 13. January 21 to February 16, 1936.

Complaints.—Failing vision, diplopia and headache.

Present Illness.—Seven months ago pain developed in her left hip causing her to limp. The pain progressed steadily for three months when she was no longer able to walk. Roentgenograms were taken and were said to have been negative. A month later a second roentgenologic examination revealed an abnormality about the epiphysis at the head of the femur and atrophy of its neck. The leg was placed in a plaster spica. The pain immediately disappeared. She felt better, ate heartily and gained some weight. A month later, *i.e.*, two months ago, she had an attack of vomiting. One month later, *i.e.*, one month ago, she complained of dizziness and headache over both eyes. Within a week her eyesight became blurred, there was double vision and the headache had become much more severe. It was then located in the occipital as well as the frontal region. There were pain and stiffness in the neck. Vomiting became more severe, occurring several times a day. Three weeks ago the plaster spica was removed and an appendicectomy performed because of the vomiting. There was no upset following the operation, and although her headache continued, the vomiting ceased. One week ago her vision had become so poor that she could only recognize light with the left eye. She was still able to read with the right eye. For the past three or four weeks there have been attacks of numbness in the right leg (not the leg in the spica).

Examination.—Patient is a sallow, fairly well nourished, young girl suffering severely with headache. Temperature normal; pulse 110; respirations 24; blood pressure 120; W.B.C. 7,800. There is a definite cracked-pot sound (Macewen's sign) on tapping the frontoparietal suture line. Moreover, roentgenologic examination showed separation of sutures—unusual at the age of 13, and indicative of an extreme degree of intracranial pressure. There is only light perception in the left eye. She can read ordinary print with the right eye. Being bedfast and in a plaster spica, a more detailed eye examination is not possible. There is papilledema of five to six diopters in the right eye; two to three diopters in the left (the blind eye). The disk and surrounding retina are filled with large flame-like hemorrhages; these are more pronounced on the right side. There is

weakness of the external rectus muscle on the left, but the parents say this has always been present. The knee jerks on the right could not be elicited; the left leg is in a plaster spica. Babinski is negative; no clonus.

Diagnosis.—Although I had suspected a tuberculous hip and a metastatic infection of the brain, Dr. George Bennett, who saw her with me, excluded tuberculosis from the study of the roentgenograms. The coexistence of the two lesions made us suspect a relationship between the two, but the only positive finding in the hip was the epiphyseal separation and atrophy of the neck and upper part of the shaft. There was no positive infective process.

Trephine and Air Injection.—January 22, 1936. The right ventricle was tapped. Fluid spurted out under tremendous pressure—at least at a distance of three feet. About 15 cc. of fluid escaped and then the flow shut down abruptly. Ten cubic centimeters of air were injected under pressure to replace the fluid. The ventriculograms showed a perfectly normal ventricular system. The fluid showed four cells, all lymphocytes. A guinea-pig was inoculated with the fluid, because of the suspicion of tuberculosis; it had no effect upon the animal.

A right subtemporal decompression was performed immediately after the ventriculograms had been interpreted. The dura was exceedingly tense. A small nick was made in the dura, hoping that fluid might be encountered and thus reduce the terrific tension. A large amount of fluid did escape, but it seemed to make little, if any, impression upon the tension of the dura. The dura was rapidly opened but the pressure was still so extreme that the cortex ruptured inferiorly. The intracranial pressure had just about reached its limit.

Following the operation the decompression was exceedingly tense. A spinal puncture on the third day after operation registered 460 Mm. of water; this, in spite of the decompression. With this great pressure it looked as though the decompression would be futile. A lumbar puncture was performed on each of the following seven days; about 30 cc. of fluid being removed each time. On the eighth day after operation the spinal fluid pressure registered 350 Mm. The tension of the decompression gradually decreased during the next five days. On the fourteenth day the decompression was flat and the spinal fluid pressure measured 160 Mm. Patient remained in the hospital a week longer. The decompression remained perfectly flat throughout that time.

For a few days after operation patient was unable to see with either eye. As the pressure became less her vision returned and at the time of her discharge she was able to read fine print with the right eye, but the left eye still remained blind. Her general condition had changed entirely, her color was better, and she was very much more alert and active mentally.

Subsequent Course.—When examined by me three months later, she was totally blind, had severe headaches, and the decompression was as full and as tense as it could possibly be. The left optic disk showed extreme optic atrophy with sharply defined disk and normal sized veins. The right had much the same appearance but slightly less advanced. It did not look as though vision could ever return. Within two weeks the decompression was again flat, and vision returned in the right eye. February 12, 1937, 13 months after operation, she was well; had had no more evidences of increased pressure, the decompression had remained soft; her vision was 20/70 in the right eye and there was a fairly normal field of vision. Her femur has healed and gives no trouble; there is no limp.

Case 13.—Unit 69343: R.W. F. Age 31. July 8 to 20, 1936.

Complaints.—Headache and blurred vision.

Past History.—Aside from a chronic discharging ear on the left side since the age of nine, the past history is negative.

Present Illness.—This is dated, by the patient, to an automobile accident five years ago. Since this time she has had occipital headaches; more recently they have become generalized. At times there is a feeling of giddiness and unsteadiness on her feet, but no

true vertigo. At times there are spots before her eyes and the vision is blurred. There has been no diplopia.

Examination.—Patient is a rather obese, well developed, healthy looking but highly nervous woman. She does not appear ill. Blood pressure is 124/76; blood Wassermann negative. There is papilledema measuring two diopters in each disk. There are a few small hemorrhages about each disk. The visual fields and visual acuity are normal.

Trephine and Air Injection.—June 13, 1936. Both ventricles were small. Ten cubic centimeters of fluid were removed from each ventricle and an equal amount of air injected. The ventriculograms were negative. The ventricular pressure could not be determined because the ventricles were too small. The ventricular fluid showed three cells and a negative Pandy.

Spinal Puncture.—July 8, 1936. Pressure measured 430 Mm. of water. Fluid was clear; four cells; negative Pandy. Wassermann negative.

Operation.—July 11, 1936: Decompression. The dura was under high tension. Fluid poured out in large amounts when the dura was opened. Fluid was everywhere through the subarachnoid spaces. When the fluid had ceased to flow the brain still bulged markedly.

Subsequent Course.—January 4, 1937, patient states swelling has disappeared.

Case 14.—Unit 71733: V.D. F. Age 20. August 10 to 22, 1936.

Complaint.—Headache.

Present Illness.—Three years ago (April, 1933) severe generalized headaches developed. An examination of her eyegrounds at that time revealed choking of the right disk. She had no visual symptoms at that time; in fact no symptoms except headache. Two months later air was injected into her spine by her physician. A year later she was seen by a neurologic surgeon who performed a ventricular air injection. The ventricles were apparently normal. She was blind for 24 hours following this procedure. Since then she says her vision has not been as good as it was before. She says there has been fever off and on during her illness of the past three years. At one time she kept a record and found that her temperature rose to 100° or 101° F. nearly every afternoon. She has been examined for various infections, but nothing has ever been found. Headache still remains the only symptom. It remains essentially unchanged and is not localized.

Examination.—Patient is a normal appearing female, age 20. Her physical examination reveals no abnormalities. Blood Wassermann negative. Blood pressure normal. Roentgenologic examination of the head is normal. Neurologic examination reveals only bilateral papilledema. This is of low grade in the left eye but there is an elevation of four diopters in the right. There are no hemorrhages in the eyegrounds. Her vision and visual fields are normal.

Spinal Air Injection.—August 14, 1936. Since a tumor was not regarded as a very strong probability, a spinal air injection was made. The spinal pressure was 330 Mm. of water. One hundred cubic centimeters of fluid were removed and an equal amount of air injected. The lateral ventricles were imperfectly filled and were very small but normally placed.

Operation.—August 14, 1936. A right subtemporal decompression was performed. The brain was very tense and bulged through the dural defect, but there was no fluid on the surface of the brain.

Case 15.—Unit 74033: P.W. F. Age 19. November 3 to 11, 1936.

Complaints.—Blurring of vision; double vision; headaches.

Present Illness.—Three months ago vision became blurred and distant objects were seen double. Headaches began at the same time; they were generalized and appeared to begin and end in no particular region; they were somewhat worse at night. There was no vomiting or vertigo.

Examination.—Blood pressure, 124/70. Wassermann negative. Neurologic examination is entirely negative except for bilateral papilledema of two diopters and some diminution in visual acuity. There are numerous hemorrhages about both disks. The

visual fields are normal. The visual acuity is 20/40 in each eye. The blind spots are perhaps very slightly enlarged. *Tentative Diagnosis:* Brain tumor.

A lumbar puncture was performed immediately before the air injection. The pressure registered 530 Mm. of water. On account of the severe pressure, air was not injected by the spinal route.

Trephine and Air Injection.—November 4, 1936. Intracranial pressure was very high, the fluid spurting. The ventricular system was entirely normal.

Operation.—A right subtemporal decompression was performed the same day. The brain was very tense, and great quantities of fluid poured from the arachnoid when it was punctured. At the time of closure the cortex bulged slightly.

Subsequent Course.—June 10, 1937. Patient states that the operative area swells when she lies down; at other times it is flat. Her vision is good.

Case 16.—Unit 74464: B.F.S. M. Age 29. December 8 to 18, 1936.

Complaints.—Headaches and loss of vision.

Family and Past Histories.—History of syphilis. Patient lost the left eye in an accident during childhood.

Present Illness.—Three years ago headaches began; they were in the occiput and behind both ears. For six months the neck was stiff. He then began vomiting and the headaches became intensified, subsequently subsiding. During the past three months more or less constant dull frontal headaches have occurred. For the past two months the vision in his left eye (only) has been impaired. He also thinks he has staggered during this time; some dizziness, frequent vomiting; loss of 34 pounds in weight.

Examination.—Patient is a very much undernourished, ill looking man with sallow complexion. He clearly shows the loss of 34 pounds in weight. Blood Wassermann four plus. Papilledema of two diopters in the left eye—the right has been removed. There are no other positive neurologic findings.

Trephine and Air Injection.—December 9, 1936. The ventricular system was entirely normal. Later the pressure of the spinal fluid measured 250 Mm. of water; there were no cells; Pandy was positive and the Wassermann four plus.

Right Subtemporal Decompression.—December 11, 1936. Since patient had only one eye a decompression was made, even though the intracranial pressure was not greatly increased. The brain bulged moderately, with a fair amount of fluid, after the evacuation of which the brain became flush with the dura. The patient was discharged December 18, 1936.

Letter May 18, 1937: Condition is essentially unchanged.

Case 17.—Unit 104829: A.S. M. Age 44. April 19 to 29, 1937.

Complaints.—Pain in the back of the head and blurring of vision.

Present Illness.—Began three months ago when a severe pain developed in the lumbar region and radiated to the back of the head where a severe headache developed which persisted for two days. During the time of the severe headache there was a numbness and tingling in his right foot and hand, but there was no loss of motor power. One week ago he vomited on several occasions. Nine days after the first attack a similar lumbar pain again developed which radiated to the head; this persisted for only one day but the back pain lasted for ten days; only during the past week has he been free of it. Ten days ago diplopia developed but soon disappeared; it recurred several times during the following three days. His vision has been blurred to such an extent that he has been unable to read fine print. At the present time there is very little headache and this is not at all localized. It is not intensified by change of position.

Examination.—Patient is a well developed, well nourished man. Blood pressure 126/84; blood Wassermann negative. There is bilateral papilledema of three diopters and numerous hemorrhages in both eyegrounds; the veins are full and tortuous. The visual fields are normal, but the visual acuity is reduced to 20/30 in each eye following correction by glasses. Possibly there may be slight weakness of both external recti. Roentgenologic examination of the head is negative.

Ventricular Air Injection.—April 20, 1937. Fluid spurted under marked pressure. Fifteen cubic centimeters of fluid were removed and an equal amount of air injected. The ventricular system was normal.

A spinal puncture was performed immediately and registered 480 Mm. of water. The fluid showed four cells, no globulin and negative Wassermann.

Operation.—A decompression was performed on the same day. The brain was exceedingly tense. There was quite a little fluid on the surface, enough to reduce the pressure so that finally the brain bulged but slightly beyond the cranial vault. Patient was discharged from the hospital nine days later. At the time of his discharge the decompression area bulged but slightly.

Subsequent Course.—Three weeks later the site of the decompression had suddenly become very full and tense. He said before this it had not protruded. This fulness and increased tension had been present for the preceding 48 hours.

Case 18.—Unit 103973: H.B. Colored F. Age 29. April 28 to May 10, 1937.

Complaint.—Pain in the head.

Present Illness.—One year ago bifrontal headaches began; they also extended into the temporal region and were especially pronounced just back of the eyes. They were intensified by bending over and on returning to the upright position. For the past three weeks the headache has been very severe. There has been slight diminution in visual acuity, but no diplopia. There have been no other symptoms.

Examination.—Patient is a rather obese, but healthy looking colored woman. The physical examination is entirely negative except for a slightly increased blood pressure which registers 150/90; three weeks previously, when taken in the dispensary, it was 170/100. Blood Wassermann negative. Urine two plus albumin. There is papilledema of two diopters in each fundus. There are no hemorrhages. The visual fields are normal; visual acuity 20/15 in each eye. Roentgenograms of the head are negative.

Ventricular Air Injection.—April 28, 1937. Entirely negative. The ventricles were rather small.

Spinal Puncture, May 3, 1937, registered 250 Mm. of water. The Queckenstedt test was negative on both sides. The spinal fluid contained no cells and no globulin; Wassermann was negative.

Operation.—A right subtemporal decompression was performed May 5, 1937. The brain was very full and tense. There was almost no fluid on the surface of the brain so that it bulged markedly at the time the temporal muscles were approximated.

Case 19.—Unit 27262: M.G. F. Age 24. October 4 to 25, 1929.

Complaint.—Headache.

Present Illness.—Began two years ago with terrific headaches lasting a few hours and occurring every five or six days; they were mainly in the right frontal region. Four months ago they became more severe and were present almost every day. During the past month the headaches had been almost constant, but worse at night. On two occasions the patient had vomited when the headache was especially severe. There had been a little dizziness at times, particularly when the patient moved abruptly or stooped over.

Examination.—Patient is a large well nourished, well developed colored girl, age 24. Blood pressure 110/82; pulse 70. Blood Wassermann negative. There is bilateral papilledema of four diopters, a little more marked on the left, and a few small hemorrhages at the disk margin on the left. Her vision is normal.

Trephine and Air Injection.—October 5, 1929. Fluid spurted under high pressure, but only a few cubic centimeters were obtained. Ten cubic centimeters of air were injected under pressure. Ventriculograms showed the ventricular system to be entirely normal. There were three cells and no globulin in the ventricular fluid. Wassermann negative.

Operation.—October 5, 1929. As the right ventricle was not as well filled as the left, and her headaches were definitely unilateral, we felt that if it were a tumor it would be on the right side. Accordingly an exploration of the right hemisphere was made. The brain was very tense, but there was fluid everywhere in the sulci, and when this was

evacuated and the ventricle tapped it was not difficult to close the dura. A decompression was not performed.

Subsequent Course.—On October 22, 1929, 17 days after operation, another air injection was performed. Again the ventricular fluid was under high pressure and the ventriculograms again showed the ventricular system to be entirely normal. The patient was seen two months later, at which time the papilledema was still present, but less than when she was in the hospital. She was then free of headaches entirely. A letter April 1, 1936, says patient is normal in every way and vision is unaffected.

Case 20.—Unit 65474: S.M. M. Age 48. October 14 to November 23, 1935.

Complaints.—Headache and drowsiness.

Past History.—Negative, except that patient is said to have had attacks of kidney stone without hematuria.

Present Illness.—Patient was first seen when he was comatose. He had right sided headaches for the past three weeks. When the headaches began he had suddenly become irrational. A spinal puncture was done at his home and a pressure of 300 Mm. of water was reported. Following this he was somewhat improved. He was brought to a hospital in Baltimore where he again suddenly became drowsy, then unconscious. A lumbar puncture was done in another hospital; it measured 200 Mm. and the fluid was said to have been xanthochromic.

A careful neurologic examination was made by Dr. Irving Spear and was entirely negative. I saw him when he again passed into coma; at this time his pulse ranged between 60 and 70. I thought he had a brain tumor and advised ventriculography.

Trephine and Air Injection.—October 14, 1935. Air injection showed definitely increased pressure, though it was not excessive and was not measured. Twenty-five cubic centimeters of fluid were removed and an equal amount of air injected. The ventricular system was entirely normal. As the fluid was somewhat bloody, a cell count and globulin examination were not made. During the next few days the patient became gradually more responsive, but was disoriented and had hallucinations. He had some pain in the right side of his head. Gradually he became quite normal again.

Nine days after the operation for ventriculography, he still complained of a little headache. A lumbar puncture was done and registered 160 Mm. of water. The fluid was perfectly clear and there were no cells and no increased globulin.

On October 29, 1935, there suddenly developed a severe attack of auricular fibrillation with pulse deficit of 64; the heart beat was 144. Under treatment improvement began at once and the heart rate was soon normal, and remained so up to the time of his discharge. His wife then recalled that he had had a seemingly similar attack at the beginning of his present illness. Following this last attack his general condition was improved and he was seemingly quite normal in every way.

On October 31, 1935, another lumbar puncture was done. He was then having increased headaches and the ventricular pressure registered 230 Mm. of water. The fluid showed 48 cells and a positive Pandy, but the fluid was blood tinged. The Wassermann reaction was normal. He had no more attacks of arrhythmia or hallucinations, and his headache disappeared. He left the hospital November 23, 1935.

It should be noted that although his eyegrounds were negative on admission, there was a definite papilledema of two diopters in each eye, and a single hemorrhage in the left eye, when examined on November 11, 1935.

In view of the fact that he was symptomatically so well, that his vision could be watched, and that his spinal pressure had not been high, it was not thought advisable to perform a decompression.

Subsequent Course.—Five months later he wrote that he was quite well, except for some dizziness and pains in the head when active.

Case 21.—Unit 67255: M.D. F. Age 27. January 14 to 21, 1936.

Complaint.—Headache.

Present Illness.—Twelve days before admission patient was delivered of a full term

baby. Throughout pregnancy and delivery nothing unusual happened. Three days after confinement a sudden severe right frontal headache developed, which soon became generalized, although it remained more intense on the right side. On the following day she vomited many times, and on the next day there was intense nausea but no vomiting. The headaches persisted, though they were less severe. On the seventh day there was numbness of the left arm; this spread to the left leg and to the left side of the face. There were a number of attacks of numbness of this character during the following day, each attack lasting for about 20 minutes. There was transient diplopia. Her appetite became poor. A lumbar puncture was performed, the fluid registered 400 Mm. of water. There were four cells in the fluid.

Examination.—Patient is a well developed, large woman. She was very drowsy. At the time of her admission to the hospital her pulse, temperature, respirations and blood pressure were normal, but there was a slight trace of sugar and albumin in the urine. There was bilateral papilledema of four diopters in each eyeground and one large flame shaped hemorrhage just below the left disk. The left external rectus was paralyzed.

Trephine and Air Injection.—January 13, 1936. The right ventricle was tapped; the fluid did not appear to be under increased pressure. Fifteen cubic centimeters of fluid were removed and 10 cc. of air injected. The ventricular system was entirely normal. Patient remained in the hospital only five days. Her general condition improved rapidly. Since the attack of intracranial pressure was so acute, the vision was unimpaired, and since her vision could be carefully watched, a decompression was not considered necessary. It was hoped that the condition would clear spontaneously. At the time of her discharge there was no apparent difference in the eyegrounds and the abducens palsies remained.

Subsequent Course.—Letter May 15, 1936 (four months after admission to the hospital): Patient reports that she is perfectly well in every way. Her double vision has cleared. Ophthalmoscopic examination is entirely negative.

Case 22.—Unit 74786: A.K. M. Age 21. January 4 to 13, 1937.

Complaints.—Headache and dimness of vision when reading.

Present Illness.—Began eight months ago with headaches which were generalized. There has been some dimness of vision during the past eight months. He has had no other symptoms. A lumbar puncture had been performed a week before admission, which registered 250 Mm. of water. Subsequently, when tested by us, it was 300 Mm.

Examination.—Patient is a well nourished, normal appearing young man, age 21. Blood pressure 130/75. Blood Wassermann and roentgenologic examination of the head are negative. The neurologic examination is entirely negative, except for bilateral papilledema of one and two diopters in each eye. There are no hemorrhages in the eyegrounds. Vision is 20/30 in the right eye, and 20/40 in the left. Visual fields are normal. Blind spots are not enlarged.

Trephine and Air Injection.—January 8, 1937. Only about 5 cc. of fluid were obtainable. Ten cubic centimeters of air were injected, each ventricle being filled independently. The ventricular system was very small, but of normal shape. A tumor could be definitely excluded.

A lumbar puncture was made three days later in order to check the previous findings of increased pressure. It now registered 300 Mm. of water, and contained three cells, globulin negative; Wassermann negative. A decompression is held in abeyance awaiting visual examination a month hence.

Subsequent Course.—Patient was well and had normal vision on May 1, 1937 (four months).

Age and Sex Incidence.—The youngest patient was nine and one-half, the next 13 years of age; the latter had much the more rapid and severe intracranial pressure in the series. One other case was under 20, and a fourth just 20. Seven occurred in the second decade. Half of the patients were,

therefore, in the first two decades and the remaining in the third and fourth decades. The oldest patient in the series was 48.

Sixteen of the patients were females and only six were males. Two (females) were colored.

Symptoms.—Headache or pain was the first symptom in 17 cases; blurring of vision was the first symptom in four cases, although in two it was practically synchronous with the headache. Dizziness, drowsiness and vomiting were the other three initial symptoms.

Dizziness—a sensation of swooning or uncertainty in the head, not a sensation of whirling objects—was a fairly common disturbance and was doubtless a symptom of intracranial pressure and not of localizing import. It occurred in 12 of the 22 cases.

Nausea was present in seven; vomiting in 11, and diplopia in 11 of the 22 cases. These symptoms occurring in about half of the cases are also due to intracranial pressure.

Duration of Symptoms.—In 13 of the 22 cases the symptoms had been present less than a year when the patient applied for treatment. The shortest duration of symptoms was 12 days; another was three weeks; in neither of these were the symptoms severe and in neither was an operation performed. In several cases the symptoms were of only three months' duration. The most fulminating case in the series had had symptoms only ten weeks and was then permanently blind in one eye. Symptoms were present for a year or more (five years in one) in six cases (22 per cent).

The Eyegrounds.—In every case papilledema was present and was the outstanding objective finding. In every instance (excepting one patient who had only one eye) the papilledema was bilateral and usually it was symmetrical; occasionally it was slightly greater in one eye. The papilledema varied from one to four diopters. Hemorrhages were very common (15 of the 22 cases). In 11 cases the hemorrhages were bilateral, in four unilateral. Usually they were multiple and scattered over or beyond the disks; in two cases only a single hemorrhage was found in the eyegrounds.

Vision.—Blurring of vision was one of the most common complaints. Reduction in visual acuity, enlarged blind spots, scotomata and blindness were found in 11 cases (50 per cent).

Other Symptoms.—Numerous other complaints have been assembled but with few exceptions there is no semblance of uniformity. The most common complaint, except those enumerated above, was staggering gait in four cases, though in one instance it lasted for only one day. In six cases there was numbness of some part or parts of the body. There were episodes of numbness in both hands (two cases), a leg, an arm, one side of the face and half of the body (each one case); weakness of both arms and legs (one case) and transient hemiplegia (one case). Buzzing of one or both ears was a symptom in three cases. Other complaints were drowsiness in spells (one), nycturia (one), hallucinations (one), anosmia (one), stiffness of neck (one), pain in lumbar region (one) and loss of weight (one).

SUPPLEMENT

TO THE ARTICLE BY

DOCTOR WALTER E. DANDY
BALTIMORE, MD.

ON

INTRACRANIAL PRESSURE WITHOUT
BRAIN TUMOR

DIAGNOSIS AND TREATMENT

COMPLETE RESUME OF ALL PHASES OF THE 22 CASES REPORTED IN THIS SERIES																																		
Name	Spinal Pressure	Ventricular Pressure	Operative Tension	Position	Age	Sex	First Symptom	Time Before Admission	Dizziness	Headache	Nausea	Pupils	Papilledema	Hemorrhage in Eyegrounds	Vision	Diplopia	Other Symptoms	Other Objective Findings in All Examinations	Roentgenogram of Skull	Diagnosis Before Cerebral Pneumography	Cerebral Pneumography	EXAMINATION OF CEREBROSPINAL FLUID			Blood Wassermann	Blood Pressure	Treatment	ULTIMATE RESULT			Lapsed Time Since Operation	Possible Etiology	Remarks	
																						Cells	Globulin	Wassermann				Life	Vision	Papilledema				
No. 1—B. O. U-11820 4/27/27	Not made	Fluid spurted	Increased	Full and tense	21	F.	Headaches; failing vision	3 mos.	+	Occipital			2½ diopters, bilateral	Many; bilateral	Normal	No	Staggered 1 day	None	Negative	Brain tumor	Normal		Negative	Negative	118/70	Decompression	Living and well	Normal	None	1/1/37	10 yrs.		Decompression, 1/1/37, baggy and little full, but not tense; for several years it varied at times, being full and tense; at other times, soft. Recently always soft	
No. 2—V. R. U-27949 11/12/29	Not made	Fluid spurted	Maximum bulging of brain	Bulging, full and fairly tense when discharged	27	F.	Headache	2 yrs.	No	One to 10 or 12 attacks a month	+		3 diopters right, 2 diopters left; known to have been present 6 mos.	+	Left	Progressive loss past 6 mos.; constriction of fields; in attacks; more right	No	Buzzing in ear; staggering gait; several spells of numbness in right side of face	Hypo-esthesia right trigeminal area; enlarged blind spots, same both eyes. (Romberg negative—hearing normal)	Negative	Unlocalized brain tumor, possibly cerebellar	Normal, small ventricles	8 (lymphocytes)		Negative	Negative	110/50	Right sub-temporal decompression	Living and well	Normal	None	7½ yrs.		Decompression remained full and tense for 4 yrs., then became flat and has remained so (3½ yrs.)
No. 3—M. C. U-29509 2/13/30		Fluid spurted	Moderate increase	Moderately full	45	M.	Drowsiness	10 mos.	No	None		No	Early papilledema	None	Normal	+	Bradycardia 38 to 40; arms and legs weak in spells	None	Negative	Brain tumor	Normal ventricles		Negative	Negative	120/60	Exploration and decompression, left	Living and well				7 yrs.			
No. 4—A. C. U-42619 4/5/32	330 Mm.	Uncertain	None at time of operation	Full and tense at times; at other times flat or sunken. Persists after 5 yrs.	42	F.	Dizziness	8 mos.	+	Attacks of right hemi-crania	+	No	4 diopters each side	+	Bilateral	Normal	+	Diminished sense of smell	Negative, except for loss of smell	Negative	Tumor of third ventricle	Normal ventricular system (not enlarged)	6		Negative	Negative	112/76	Right sub-temporal decompression	Living and well	Normal	None	5 yrs.		The decompression is still full at times and becomes quite tense, but goes down as quickly as it comes and during much of the time is flat or slightly sunken. Has had 4 or 5 convulsions since operation
No. 5—B. P. U-37123 5/16/31	250 to 400 Mm. several punctures	Fluid spurted	High grade	Varied; full and fairly tense when discharged	23	F.	Impaired vision	8 mos.	+	Periodic attacks	+	No	3 diopters right, 1 diopter left	None	About normal; had many blind spells affecting one or both eyes	No	Clumsiness and weakness of right side; also left leg and clumsy gait—all transient—occurred 2 yrs. after onset	Enlarged blind spots, later cleared. Clumsiness of right side, later cleared	Negative	Brain tumor	Normal, small ventricles	36 (lymphocytes); 1 yr. later, 16 cells	+	50 mg. %	Negative	Negative	114/72	Right sub-temporal decompression	Living and well	Normal	None	6 yrs.	Multiple sclerosis?	The diagnosis of multiple sclerosis was considered because of the late appearing disturbance of gait and clumsiness of the right side—all transient
No. 6—C. B. U-43567 5/28/32	550 Mm.		Greatly increased	Tense and full	46	F.	Throbbing pain over right eye and right mastoid	4 mos.	+	+		No	4 diopters, bilateral	Bilateral	Normal	No	Tinnitus in right ear	None	Negative	Brain tumor	Normal ventricles	2		Negative	Negative	128/80	Decompression				5 yrs.			
No. 7—A. R. U-45653 10/3/32	280 to 330 Mm.	Fluid spurted	Markedly increased	Tense and full at times; at other times soft	34	F.	Headaches intermittent	8 mos.	+	More on right, but general; eventually strictly right sided	+	+	2 diopters, bilateral	None	Normal	+	Stiffness neck; sensation of pins and needles in both arms		Negative	Brain tumor	Normal ventricles	4		Negative	Negative	110/80	Decompression	Living and well	Normal	None	5 yrs.		Decompression is still quite full and very tense (July, 1937)	
No. 8—S. H. U-46919 12/15/32	320 Mm.	Uncertain	Moderate pressure	Slight protrusion	32	F.	Headache, suboccipital	3 yrs.		+	Suboccipital, at first intermittent, then constant and very severe for a month	+	4 diopters, bilateral	+	Many; bilateral	Almost blind in right eye; fairly good left eye	+	Began to tire easily 4 mos. ago. Numbness left arm at times; staggered in brief spells; ringing right ear. Nycturia (3x4) 2 wks.		Negative	Possibly metastatic tumor	Small, normal ventricles	2 (lymphocytes)		Negative	Negative	120/80	Right sub-temporal decompression	Living and well	Right eye normal; left blind (6/4/36)	Not examined since operation	4 yrs.		Ovarian (?) tumor removed 3 yrs. ago—just before headaches began. Says decompression still bulges and becomes tense at times, usually flat; nervousness causes increase in size of decompression
No. 9—E. V. U-60526 2/6/35	500 Mm.	Uncertain	Greatly increased	Remained soft after operation	9	F.	Headaches	5 mos.	+	Recurring severe attacks, not localized		+	3 diopters, bilateral	+	Bilateral	20/50 each eye	+	Numbness of both hands at times	Romberg +; falls backwards. Knee jerks hyperactive; tuberculin test +	Negative	Tumor, or tubercle of brain	Small, normal ventricles	4 (lymphocytes)		Negative	Negative	120/70	Right sub-temporal decompression	Living and well	Normal	Absent 3/12/37			
No. 10—A. M. U-66287 11/22/35	Not tested	Fluid spurted	Greatly increased	Tense and full	44	M.	Headaches	8 mos.	+	Right frontal, periodic		No	3 diopters, bilateral	Bilateral	Normal	No	None		Negative	Brain tumor	Normal ventricles		Negative	Negative	118/64	Decompression	Living and well	Normal	None 3/7/37	18 mos.		3/17/37: Decompression full and tense, but varies greatly and with great rapidity—one extreme to the other in 2 minutes		
No. 11—R. H. U-67385 12/20/35	Not made	Fluid spurted	Increased	Tense and full	41	F.	Blurring of vision	3 mos.		None			3 diopters, bilateral	Many; bilateral	Normal	No	None	None	Negative	Brain tumor	Normal			Negative	Negative	140/76	Decompression	Living and well	Normal	None 3/25/37	18 mos.		Decompression still full and tense, 2/15/37 (15 mos.)	
No. 12—S. W. U-67385 1/21/36	460 Mm.	Fluid spurted	Highest grade	Very tense 2 wks., then flat	13	F.	Vomiting	10 wks.	+	+	+	+	4 diopters right, 2 diopters left	+	Bilateral; many and large	Blind left eye; also right for several days	+	Occasional attacks numbness right leg—transient (left leg in spica)	Left pupil reactionless	Separation of fronto-parietal sutures (age 13)	Possibly tubercle of brain	Normal, small ventricles	4 (lymphocytes)		Negative	Negative	120/80	Right sub-temporal decompression	Living and well	Blind left eye; vision returned in right	Disappeared. Now primary atrophy	16 mos.		Other cases in the literature have stressed relation between fractured femur, traction, etc., and intracranial tension. This does not appear probable. 3 mos. after discharge decompression suddenly became exceedingly full and tense and vision lost completely. Within a month decompression again soft and flat and vision again returned in right eye. Advanced primary optic atrophy of disks so great that return of vision had not seemed possible. Leg has healed perfectly
No. 13—R. W. U-69343 6/10/36	430 Mm.	Fluid spurted	Greatly increased	Tense and full	31	F.	Headache	5 yrs.	+	Generalized and occipital		No	2 diopters, bilateral	Few; bilateral	Blurred; large central scotoma left; right 20/30; left 3/200		3 mos. before operation, vision was normal in both eyes	None; very neurotic person	Negative	Brain tumor	Ventricles normal, but very small	3		Negative	Negative	120/75	Decompression	Living and well	Normal		1 yr.			
No. 14—V. D. U-71733 8/10/36	300 Mm.	Not made	Greatly increased	Tense and full; no fluid over brain	20	F.	Headache	3 yrs.	No	+		No	4 diopters right, 1 diopter left	None	Normal	No	Said to have had a fever over a long period	None	Negative	Brain tumor	Normal ventricles. (Spinal injection)		Negative	Negative	90/70	Decompression	Living and well	Normal			10 mos.			
No. 15—P. W. U-74033 12/3/36	530 Mm.	Fluid spurted	Greatly increased	Full and tense	19	F.	Headache	3 mos.		+		No	2 diopters, bilateral	Many; bilateral	20/40 each eye diminished	+		None	Negative	Brain tumor	Normal ventricles		Negative	Negative	104/45	Decompression	Living and well	Normal			6 mos.			
No. 16—B. F. S. U-74464 12/8/36	250 Mm.	Increased pressure could not be demonstrated by puncture	Moderate bulging	Definite but moderate pressure	29	M.	Headache	3 yrs.	+	Frontal generalized	+	No	2 diopters in left eye (only)	None	Blurred but test 20/20	Right eye has been removed	Marked loss of weight	None	Negative	Brain tumor	Normal ventricles		+	Positive	Positive	142/80	Decompression	Living and well	Same as before		5 mos.	Syphilis?	Patient had syphilis	
No. 17—A. S. U-104829 4/19/37	480 Mm.	Fluid spurted	Greatly increased	Full and tense	44	M.	Headache and blurring vision	3 mos.		+	Not constant	+	No	3 diopters, bilateral	Many; bilateral	Acuity 20/30	+	Numbness and tingling right hand. Pain in lumbar region, associated headache	Perhaps slight weakness of both external recti	Negative	Brain tumor	Normal	4		Negative	Negative	126/84	Decompression	Living and well			1 mo.	Relationship to queer lumbar pain?	The curious relationship of the severe lumbar pain which initiated the condition is doubtless significant
No. 18—H. P. U-103973 4/26/37	250 Mm.	Fluid spurted	Greatly increased	Full and tense	29	F. col.	Bifrontal headaches	1 yr.		+		No	2 diopters, bilateral		Normal	No	Headaches intensified by bending	2+ albumin in urine	Negative	Brain tumor	Normal			Negative	Negative	150/70	Decompression	Living and well			1 mo.			
No. 19—M. G. U-27262 10/4/29	Not tested	Fluid spurted	Increased	Not made	24	F.	Headaches intermittent, later constant	2 yrs.	+	Right frontal	+	+	4 diopters, bilateral	On left	Normal	No	None	None	Negative	Brain tumor	Normal ventricles	3		Negative	Negative	110/82	Exploration of hemisphere	Living and well	Normal	None	7½ yrs.			
No. 20—S. M. U-65474 10/14/35	300, 230, 200 and 160 Mm.	Moderately increased	No operation	No operation	48	M.	Pain right side of head	3 wks.	+	+	Over right eye	+	No	2 diopters, bilateral; developed in hospital; none on admission	+	Single hemorrhage, left	Normal	Hallucinations, irrational, drowsy, and even comatose in spells; lucid in intervals	Severe attacks of auricular fibrillation with large pulse deficit (64); one occurred beginning present illness	Negative	Brain tumor	Small, normal ventricles	No cells; later 48 cells; fluid blood tinged	Later + 50 mg. % fluid blood tinged	Negative	Negative	110/75	None	Living and well	Normal	Developed in hospital, and present when discharged	20 mos.		
No. 21—M. D. U-67255 1/14/36	400 Mm.	Apparently normal	No operation	No operation	27	F.	Headache	12 da.		+	Generalized, worse on right	+	No	2 diopters, bilateral	Single large hemorrhage, left	Normal	+	Childbirth 13 da. before onset of headache	Abducens paralysis	Negative	Brain tumor	Small, normal ventricles	4		Negative	Negative	120/80	None	Living and well	Normal	Absent 4/6/36	15 mos.	Relation to pregnancy?	
No. 22—A. K. U-74786 1/4/37	300 Mm.	Ventricles too small to make determination of pressure	No operation	Not made	21	M.	Headache	8 mos.		Generalized			2 diopters, bilateral	None	Slightly reduced	No	None	None	Negative	Brain tumor	Tiny, normal ventricles			Negative	Negative	118/75	None	Living and well	Normal	None 2/26/37	5 mos.			

Findings from Various Examinations.—The neurologic examinations were practically negative in every case. A positive Romberg was disclosed only once, hyperactive knee jerks, once, abducens palsy, twice. In only a single instance did the roentgenologic examination disclose a positive finding; the frontoparietal sutures were separated in a girl of 13 who had the extreme intracranial pressure over a short period of time.

The blood pressure was elevated in only one instance; it was 150/90 in a woman age 29. At an earlier examination it was said to have been 170/100. Her urine also contained two plus albumin.

In only one case was the Wassermann reaction positive in the blood and spinal fluid. He gave a definite history of syphilis.

The Cerebrospinal Fluid.—With two exceptions the cell count and globulin were well within normal limits. In one case a lymphocyte count of 36 was recorded. A year later on reexamination there were 16 cells. She also had 50 mg. of albumin. She is still living and well six years later, so there can be no serious significance to the increases. In only one other case in the series was there globulin in the cerebrospinal fluid (the patient with syphilis).

Intracranial Pressure.—The pressure of the spinal fluid varied from 250 to 550 Mm. of water. In Case 12, a girl, age 13, the frontoparietal sutures were separated by the intracranial pressure. This was evident by percussion of the head (MacEwen's sign) and in the roentgenograms. In no other case in the series was the roentgenologic examination of any value.

Ventriculography.—In every instance the ventricles have been small—usually markedly undersized—and symmetrical. An intracranial tumor causing the grade of intracranial pressure that is indicated by the papilledema, hemorrhages and measured pressure could not exist with such small symmetrical ventricles.

Treatment.—The treatment of these cases is purely upon a mechanical basis. A right subtemporal decompression is performed if the symptoms and objective signs (eyegrounds and vision) indicate its need. It is necessary in most, but not all, cases because the intracranial pressure frequently persists for months, and frequently years. In four cases in this series there was every indication of a mild degree of intracranial pressure but since the vision and eyegrounds could be periodically observed they were not operated upon. So far, in every case there has been every indication of a complete, spontaneous cure. When operation is indicated the maximum opening in the subtemporal region should be provided. Although the pressure is always high, the cortex has never ruptured in the bony defect. The latter complication is avoided because sufficient fluid escapes from the subarachnoid space to reduce the pressure. Nor has the decompression—although very full and tense—suggested the need of further temporary relief by puncture of the spinal canal. There was one exception to this statement, the little girl previously mentioned with the extreme pressure (Case 12). Following a spinal puncture with collapse of the decompression, the pressure returned to its maximum within an hour.

SUMMARY AND CONCLUSIONS

The facts concerning this condition may be summed up from the 22 cases reported, as follows: There is intracranial pressure of varying duration and intensity. Frequently it persists over several years, though it may be of only a few months' duration. Usually in each individual there are marked variations in the degree of intracranial pressure from time to time and the changes from one extreme to the other and in either direction may occur, at times at least, very rapidly, *i.e.*, over a period of a few minutes. The subjective disturbances are those of intracranial pressure alone, though at times vague neurologic symptoms may appear; the latter, when present, are fleeting, inconstant, and too ill defined to be of localizing significance. This condition is both immediately and permanently controlled (possibly with rare exceptions) by a subtemporal decompression. To this extent, therefore, it is a self limited disease. Without operative relief, vision, at least, is lost. On the other hand, spontaneous recovery may result before vision is seriously affected. The effect upon life is difficult to estimate, but it is quite probable that in only the most severe grades would life be lost.

The cause of this condition is not known. It can be reasoned with safety that the increased intracranial pressure is dependent upon the intracranial fluid content, *i.e.*, either blood or cerebrospinal fluid, otherwise the very rapid changes could not occur. But whether blood or cerebrospinal fluid is chiefly or entirely responsible can only be conjectured. Moreover, the variable fluid content must be in the brain itself and not in the meningeal spaces. Proof of this statement is demonstrated by two observations: (1) The protruding brain at the time of operation is usually only partially, and at times scarcely at all, relieved by evacuating the fluid from the subarachnoid spaces over the temporal lobe; and (2) because the ventricular system is always small, and usually much smaller than normal. If the fluid in the meninges were increased the ventricular system would naturally participate and, therefore, be correspondingly enlarged from the backlog. Since fluid is never in the subdural space the only other place where it could form in excess and cause intracranial pressure would be in the substance of the brain. Fluid in this position would maintain the fulness of the brain after evacuating the subarachnoid space and would also diminish rather than increase the size of the lateral ventricle. Whether or not such a condition actually obtains, or could obtain, I do not know. Disturbances of this kind are not known, nor is there sufficient information concerning the circulation of fluid within the brain to advance a hypothesis of this kind.

The only other possible explanation of the increased pressure is by variations in the intracranial vascular bed probably by vasomotor control. It is, I think, more amply demonstrated that such influences are at work. There are at least two reasons for thinking that this may be the most satisfactory explanation. The very rapid increase and decrease of the decompression—in two or three minutes from one extreme to the other—could hardly occur except from variations in the vascular bed; certainly the change is much too

rapid for an increase or decrease of cerebrospinal fluid. And secondly, fright, fatigue, mental or physical, and sudden nervousness may cause the decompression to become more tense very rapidly. However, an abnormal psychogenic background in three patients is certainly the exception rather than the rule. In not more than one, or at most two instances, was the patient highly emotional. On the other hand, these sudden changes may be merely effects that are superimposed upon the underlying condition with another explanation. Nor is there any reason to believe from a study of these patients that the underlying condition can be dependent upon any obstruction in the big venous sinuses, for the Queckenstedt test is usually made routinely and has never been positive. Other etiologic factors are entirely unknown.

That all of these cases have, or have not, the same underlying cause I do not know. We may well be dealing with a condition that has more than one underlying anatomic or etiologic basis. The facts do not permit discussion of this thought. They behave in much the same way, except in degree and duration. Four cases with signs and symptoms of lesser degree were observed without operation and recovered in a few months. One was so fulminating that blindness of one eye resulted in two months; and three months after a seemingly complete recovery, with a collapsed decompression, the pressure again suddenly became extreme and vision was abolished in the remaining eye; within another month the pressure again returned to, and has since remained, normal, with partial return of vision in this eye. Despite every search no cause of the original or subsequent increased pressure could be suggested. She was a very placid girl and only 13 years old (Case 12).

One patient feels that "after reading or talking to people the decompression may get as tight as a drum, and within two minutes it may be perfectly soft." He also thinks that nervousness (he is not of nervous temperament), or getting in or out of a car, will cause a sudden increase in the pressure. He also thinks the decompression is more tense when he is constipated. Another patient who is chronically constipated does not think there is any relationship between the degree of pressure and her constipation, nor is there any appreciable difference.

In only one case is there reason to consider an inflammatory lesion, such as an encephalitic process, as a possible factor in this condition. In Case 5 the cell count (36) and globulin were increased, and a year later the cell count was still 16. It may well be that this case differs from the others, although the end-result is essentially the same. Certainly there have been numerous neurologic complaints in this case, although no objective findings. Indeed the history in the case is not unlike that of multiple sclerosis; but after five years she is again without neurologic symptoms. It is worthy of note also that this patient went a year with her intermittent pressure and without diminution of vision. On the whole, the periods of increased pressure may well have been of short duration.

Nor can it be denied that syphilis is a factor in Case 16, in which the Wassermann reaction from both blood and cerebrospinal fluid was positive.

In none of the remaining cases, however, do the examinations of the spinal fluid suggest an underlying inflammatory lesion of any type.

That the increased pressure usually sets its limit within the bounds of relief afforded by a subtemporal decompression is indeed surprising. In one case this was certainly not true, for the vision was lost when the decompression became more tense than any I have ever seen; recovery of vision followed the spontaneous relief of the underlying condition. It is quite certain that vision and probably even life itself were spared by the decompression that had been made.

The significance of papilledema in these and other cases of suspected intracranial pressure should be emphasized. Needless to say there is no difference between the ophthalmoscopic picture in these cases and those due to tumors, for both are due to intracranial pressure. There is another ophthalmoscopic picture, however, where a differential diagnosis is all important, *i.e.*, optic neuritis. Although it is, at times, possible by the ophthalmoscopic studies to differentiate between a mechanical papilledema due to pressure and the local one of optic neuritis, this is usually not true. In fact in a condition so serious, I should rarely feel safe in depending exclusively upon an ophthalmoscopic examination for the differentiation of these two lesions. But the differential diagnosis can be, and always should be, made by directly ascertaining the intracranial pressure.

The diagnosis of this condition is made by the ventriculograms and by measurement of the pressure of the cerebrospinal fluid. It may be reasoned that a tumor is really present and has been overlooked. If ventriculograms are properly made and carefully interpreted, no single brain tumor can fail to escape diagnosis and localization. It is possible for multiple metastatic tumors to exist throughout the brain and not appreciably deform the ventricular system. Moreover, most of the cases in this group have stood the test of time. It is not conceivable that tumors would be disclosed after several years.

Visualization of the lateral cerebral ventricles should be made by injecting air into them directly (not by lumbar puncture). If the ventricular system is normal a tumor can be excluded with absolute certainty. If there then remains any doubt whether the intracranial pressure is increased, a lumbar puncture can then be safely performed and the pressure measured. To inject air in the presence, or suspected presence, of intracranial pressure is far too dangerous to be justifiable. The secondary spinal puncture for pressure readings can be made immediately or a few days later—I usually prefer the latter though the severity of the symptoms may dictate its prompt performance. When the lateral cerebral ventricles are small the indications of increased intracranial pressure from the ventricular puncture may be absent or equivocal; it is for this reason that so many of these cases have had the spinal in addition to the ventricular puncture. Given increased pressure plus papilledema the diagnosis and indications for mechanical treatment are clear.

Without increased pressure it is equally evident that the ophthalmoscopic picture is one of optic neuritis and operative treatment is contraindicated.

The periodic nature of the attacks, and also the permanency of cure in four cases known to have remained well without treatment, lead one to suspect that this condition may be a very common one and that only the most severe grades fall into our hands; and that many of the transient, unexplainable headaches may really be instances of this condition, though in lesser degree.

DISCUSSION.—DR. WILDER G. PENFIELD (Montreal): I should like to ask Doctor Dandy if he feels that there may not be an increase in subdural fluid in those cases. Occasionally it does happen secondary to an inflammatory process in the mastoid or one of the sinuses, or secondary to trauma, that there is definite increase of subdural fluid. The subdural fluid has a higher protein content which is unable to pass through into the subarachnoid space because of the presence of that protein. Such fluid escapes at decompression and the pressure is relieved. It is difficult to be sure, in any surgical approach, where fluid comes from.

DR. ALFRED ADSON (Rochester, Minn.): There is no question but that this group does exist. In addition, I think probably we also have had the experience of examining patients who have come with the symptoms of intracranial pressure and even localizing evidence, and have used ventriculography in connection with exploration, at which time no tumor was found. A biopsy made in conjunction with exploration resulted in the report of inflammatory tissue, and I have had the same patients return several years later seeking medical release in order that they might be accepted for life insurance. It is very evident that these patients did not have brain tumors and that some of these undoubtedly had localized encephalitis. We have encountered a number of cases of retrobulbar neuritis in which there were choked disk and evidence of intracranial pressure. It was our impression that probably we were dealing with some type of leptomeningitis.

DR. WALTER E. DANDY (Baltimore) closing: I can answer Doctor Penfield's suggestion very positively. When a temporal lobe is exposed, one can, of course, see where the fluid is coming from, and it is always from the subarachnoid space. You can clearly see it coming through the arachnoid membrane.

I do not think Doctor Adson's suggestion of encephalitis probably belongs in this group. Certainly the effects of an encephalitis would not exist over as long a period as five, six or seven years. I think that is a different lesion. But neither would it account for the very sudden fluctuations in the size of the decompression for which the only explanation I can offer is that it probably has some relationship to the intracranial vascular bed. How could a decompression rise in two or three minutes and then fall in the same length of time, except from a sudden change in the vascular bed? There could scarcely be a rise and fall in the amount of cerebrospinal fluid so rapidly.